CLAIMS

1. An optical disc device comprising:

a high frequency band processing circuit for removing low frequency components of signals outputted from photodetectors of an optical pickup, and subjecting the signals to AD conversion with a high-speed low-bit AD converter, and then generating various kinds of signals required for recording/playback of an optical disc by digital processing; and

a low frequency band processing circuit for removing high frequency components of the signals outputted from the photodetectors of the optical pickup, and subjecting the signals to AD conversion with a low-speed high-bit AD converter, and then generating various kinds of signals required for recording/playback of the optical disc by digital processing.

2. An optical disc device as defined in Claim 1 wherein

said high frequency band processing circuit includes plural stages of HPFs having different cutoff frequencies which are in ascending order with respect to the signals outputted from the photodetectors of the pickup, and performs detection of plural signals required for recording/playback of the optical disc using signals of desired frequency bands which are outputted from the respective HPFs.

3. An optical disc device as defined in Claim 1 wherein said high frequency band processing circuit comprises:

first HPFs for removing DC components of the output signals from the respective photodetectors of the pickup and level fluctuations in low frequencies, said first HPFs being provided correspondingly to the output signals from the respective photodetectors;

second HPFs for receiving the output signals from the first HPFs, and removing frequencies which are higher than the cutoff frequency of the first HPFs and equal to and lower than a predetermined cutoff frequency;

AD converters for receiving the output signals from the second HPFs, and AD-converting the output signals from the second HPFs; and

third HPFs for receiving the digital signals outputted from the AD converters, and removing frequencies which are higher than the cutoff frequency of the second HPFs and equal to and lower than a predetermined cutoff frequency.

4. An optical disc device as defined in Claim 1 wherein said high frequency band processing circuit comprises:

second HPFs for removing frequencies which are equal to and lower than a predetermined cutoff frequency of the output signals from the respective photodetectors of the pickup, said second HPFs being provided correspondingly to the output signals from

the respective photodetectors;

AD converters for receiving the output signals from the second HPFs, and AD-converting the output signals from the second HPFs; and

third HPFs for receiving the digital signals outputted from the AD converters, and removing frequencies which are higher than the cutoff frequency of the second HPFs and equal to and lower than a predetermined cutoff frequency.

5. An optical disc device including a plurality of HPFs having different cutoff frequencies which are in ascending order with respect to signals outputted from photodetectors of a pickup, and

performing detection of plural signals which are required for recording/playback of an optical disc, using signals of desired frequency bands, which are outputted from the respective HPFs.

6. An optical disc device comprising:

first HPFs for removing DC components of output signals from photodetectors of a pickup and level fluctuations in low frequencies, said first HPFs being provided correspondingly to the output signals from the respective photodetectors;

second HPFs for receiving the output signals from the first HPFs, and removing frequencies which are higher than the cutoff frequency of the first HPFs and equal to and lower than a predetermined cutoff frequency;

AD converters for receiving the output signals from the second HPFs, and AD-converting the output signals from the second HPFs; and

third HPFs for receiving the digital signals outputted from the AD converters, and removing frequencies which are higher than the cutoff frequency of the second HPFs and equal to and lower than a predetermined cutoff frequency.

7. An optical disc device comprising:

second HPFs for removing frequencies which are equal to and lower than a predetermined cutoff frequency of output signals from photodetectors of a pickup, said second HPFs being provided correspondingly to the output signals from the respective photodetectors;

AD converters for receiving the output signals from the second HPFs, and AD-converting the output signals from the second HPFs; and

third HPFs for receiving the digital signals outputted from the AD converters, and removing frequencies which are higher than the cutoff frequency of the second HPFs and equal to and lower than a predetermined cutoff frequency.

8. An optical disc device as defined in any of Claims 3 and 6 wherein

the cutoff frequency of the first HPFs is a frequency that

does not adversely affect jitter of the signals outputted from the respective photodetectors of the pickup.

9. An optical disc device as defined in any of Claims 3, 4, 6, and 7 further comprising a wobble signal generation circuit for generating a wobble signal using the digital signals outputted from the AD converters.

10. An optical disc device as defined in Claim 9 wherein said wobble signal generation circuit comprises:

a logic operation circuit for performing an arithmetic operation using the digital signals outputted from the AD converters to calculate a pushpull tracking error signal; and

a digital BPF for generating a wobble signal from the pushpull tracking error signal calculated by the logic operation circuit.

11. An optical disc device as defined in Claim 10 wherein the cutoff frequency of the second HPFs is a frequency equal to or lower than a passband frequency of the digital BPF.

12. An optical disc device as defined in any of Claims 3, 4, 6, and 7 further comprising:

a pushpull track cross signal generation circuit for generating a pushpull track cross signal using the digital

signals outputted from the AD converters;

wherein said pushpull track cross signal generated by the pushpull track cross signal generation circuit is used as a track cross signal during high-speed seeking of an optical disc.

13. An optical disc device as defined in Claim 12 wherein said pushpull track cross signal generation circuit comprises:

a logic operation circuit for performing an arithmetic operation using the digital signals outputted from the AD converters to calculate a pushpull tracking error signal; and

a binarization circuit for binarizing the pushpull tracking error signal calculated by the logic operation circuit at a zerocross point to generate a pushpull track cross signal.

14. An optical disc device as defined in any of Claims 3, 4, 6, and 7 wherein

the cutoff frequency of the third HPFs is a frequency that enables removal of voltage level fluctuations, and removal of wobble components.

15. An optical disc device as defined in any of Claims 3, 4, 6, and 7 further comprising a phase difference tracking error signal detection circuit for generating a phase difference tracking error signal by digital processing using the digital signals

outputted from the third HPFs.

16. An optical disc device as defined in Claim 1 wherein said low frequency band processing circuit comprising:

LPFs having a cutoff frequency equal to or lower than 1/2 of a sampling frequency, said LPFs being provided correspondingly to signals outputted from photodetectors of a pickup;

a time-division AD converter for performing AD conversion of plural channels while successively selecting the output signals from the first LPFs;

a servo error signal generation circuit for performing a servo error signal generation operation by digital processing using the output from the time-division AD converter to generate a servo error signal; and

a servo operation circuit for performing a digital servo operation on the basis of the servo error signal generated by the servo error signal generation circuit to generate a driving signal for a driving system.

17. An optical disc device comprising:

a time-division AD converter for performing AD conversion of plural channels while successively selecting signals outputted from photodetectors of a pickup;

a servo error signal generation circuit for performing a servo error signal generation operation by digital processing

using the output from the time-division AD converter to generate a servo error signal; and

a servo operation circuit for performing a digital servo operation on the basis of the servo error signal generated by the servo error signal generation circuit to generate a driving signal for a driving system.

18. An optical disc device comprising:

LPFs having a cutoff frequency equal to or lower than 1/2 of a sampling frequency, said LPFs being provided correspondingly to signals outputted from photodetectors of a pickup;

a time-division AD converter for performing AD conversion of plural channels while successively selecting the output signals from the first LPFs;

a servo error signal generation circuit for performing a servo error signal generation operation by digital processing using the output from the time-division AD converter to generate a servo error signal; and

a servo operation circuit for performing a digital servo operation on the basis of the servo error signal generated by the servo error signal generation circuit to generate a driving signal for a driving system.

19. An optical disc device as defined in any of Claims 16 to 18 wherein

when said servo error signal generation circuit performs the servo error signal generation operation using the signals from the photodetectors of the optical pickup receiving a main beam and signals from the photodetectors of the optical pickup receiving a sub beam,

said servo error signal generation circuit controls the operation timing of arithmetic processing for the signals from the photodetectors receiving the main beam, which are outputted from the time-division AD converter, and the operation timing of arithmetic processing for the signals from the photodetectors receiving the sub beam, which are outputted from the time-division AD converter, separately from each other, and

said servo operation circuit performs the digital servo operation using the signals generated by the servo error signal generation circuit to generate a driving signal for a driving system.

20. An optical disc device as defined in any of Claims 16 to 18 wherein

said servo error signal generation circuit further includes a high-pass phase-lead filter for correcting, by phase compensation, a delay time up to the start of the arithmetic processing for the signals from the photodetectors receiving the sub beam, with respect to the start time of the arithmetic processing for the signals from the photodetectors receiving the main beam, when

said servo error signal generation circuit performs the servo error signal generation operation using the signals from the photodetectors of the optical pickup receiving a main beam and signals from the photodetectors of the optical pickup receiving a sub beam.

21. An optical disc device as defined in any of Claims 16 to 18 wherein

said servo error signal generation circuit has a servo error signal generation program for generating plural kinds of servo error signals, and includes an operation unit for performing a servo error signal generation operation using the servo error signal generation program to generate servo error signals, and

said operation unit generates plural servo error signals time-divisionally.

22. An optical disc device as defined in any of Claims 16 to 18 wherein

said servo error signal generation circuit has plural servo error signal generation programs for performing servo error signal generation operations which are adapted to the structure of the optical pickup, recording/playback media, and recording/playback mode, and includes an operation unit for performing the servo error signal generation operations using the servo error signal generation programs to generate servo error

signals, and

said operation unit performs the servo error signal generation operations while selecting the servo error signal generation programs according to the structure of the optical pickup, recording/playback media, and recording/playback mode.

23. An optical disc device as defined in Claim 22 wherein

there are plural servo error signal generation programs for each kind of servo error signal, and

said operation unit performs, for each kind of servo error signal, the servo error signal generation operations while selecting the servo error signal generation programs according to the structure of the optical pickup, recording/playback media, and recording/playback mode.

24. An optical disc device as defined in Claim 23 wherein

said operation unit changes, for each kind of servo error signal, the frequency of use of each servo error signal generation program for generating a desired servo error signal.

25. An optical disc device as defined in Claim 24 wherein

when generating, as servo error signals, full-addition signals (hereinafter referred to as AS signals), focus error signals (hereinafter referred to as FE signals), and tracking error signals (hereinafter referred to as TE signals), said

operation unit uses the servo error signal generation programs so that the generation frequency of the AS signals becomes lower than the generation frequencies of the FE signals and TE signals.

26. An optical disc device as defined in any of Claims 16 to 18 further including:

a timing control circuit for controlling the operation timings of the time-division AD converter and the servo error signal generation circuit;

wherein said timing control circuit makes the timing at which acquisition of signals from all the photodetectors required for generating one servo error signal by the servo error signal generation circuit is completed, coincide with the timing at which AD conversion of the signals from all the photodetectors by the time-division AD converter is ended.

27. An optical disc device as defined in any of Claims 16 to 18 further including:

a timing control circuit for controlling the operation timings of the time-division AD converter and the servo error signal generation circuit;

wherein, when the servo error signal generation circuit performs the servo error signal generation operation using the signals from the photodetectors of the optical pickup receiving the main beam and the signal from the photodetectors receiving

the sub beam,

said timing control circuit makes the timing at which acquisition of signals from all the photodetectors receiving the main beam, which are required for generating one servo error signal by the servo error signal generation circuit, is completed, coincide with the timing at which AD conversion of the signals from all the photodetectors receiving the main beam by the time-division AD converter is ended, and

said servo error signal generation circuit performs the servo error signal generation operation using the signals from the photodetectors receiving the main beam, which are AD-converted by the time-division AD converter, and the signals from the photodetectors receiving the sub beam, which are AD-converted one-sampling-period previously to the AD-converted signals from the photodetectors receiving the main beam.

28. An optical disc device as defined in any of Claims 16 to 18 further including:

a timing control circuit for controlling the operation timings of the time-division AD converter and the servo error signal generation circuit;

wherein, when the servo error signal generation circuit repeats the operation of generating plural kinds of servo error signals using the AD conversion result of the same channel,

said servo error signal generation circuit performs, with

higher priority, the operation of generating a servo error signal that is more likely to be affected by phase delay, and

during the servo error signal generation operation that is initially carried out by the servo error signal generation circuit, said timing control circuit makes the timing at which acquisition of signals from all the photodetectors required for generating the corresponding servo error signal is completed, coincide with the timing at which AD conversion of the signals from all the photodetectors by the time-division AD converter is ended.

29. An optical disc device as defined in any of Claims 16 to 18 further including:

a timing control circuit for controlling the operation timings of the time-division AD converter and the servo error signal generation circuit;

wherein, when the servo error signal generation circuit performs the operation of generating plural kinds of servo error signals using the AD conversion result of the same channel which is output from the time-division AD converter,

said timing control circuit makes the time-division AD converter perform AD conversion of the same channel repeatedly within one sampling period, and

during the operation of generating plural kinds of servo error signals by the servo error signal generation circuit, said

timing control circuit makes the timing at which acquisition of signals from all the photodetectors required for generating each servo error signal is completed, coincide with the timing at which AD conversion of the signals from all the photodetectors by the time-division AD converter is ended.

30. An optical disc device as defined in any of Claims 16 to 18 further including:

a timing control circuit for controlling the operation timings of the time-division AD converter and the servo error signal generation circuit;

wherein said time-division AD converter has a mechanism for arbitrarily controlling selection of a channel to be subjected to AD conversion, and channel switching timing,

the AD conversion timing of each channel by the time-division AD converter is controlled according to the operation time of the servo error signal generation operation by the servo error signal generation circuit, and

said timing control circuit makes the timing at which acquisition of signals from all the photodetectors required for generating one servo error signal by the servo error signal generation circuit is completed, coincide with the timing at which AD conversion of the signals from all the photodetectors by the time-division AD converter is ended.

31. An optical disc device as defined in Claim 30 wherein said time-division AD converter comprises:

a selector control circuit for controlling selection of a channel to be subjected to AD conversion, and channel switching timing, by outputting control signals to an input selector and an output selector;

a selector for receiving the plural output signals from the photodetectors of the optical pickup, and selecting and outputting a signal of a predetermined channel at a predetermined timing that is indicated by the selector control circuit;

an AD converter for AD-converting the signal outputted from the input selector to output the digitized signal; and

said output selector for outputting the digitized signal outputted from the AD converter, through the channel that is indicated by the selector control circuit and selected by the input selector.